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EXAMINER
BERNATZ, KEVIN M

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1773	

DATE MAILED: 09/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/075,123	Applicant(s) BERTERO ET AL.
	Examiner Kevin M Bernatz	Art Unit 1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-39 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-39 is/are rejected.

7)☒ Claim(s) 5 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1,4 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Drawings

1. The drawings were received on February 21, 2003. These drawings are accepted.

Claim Objections

2. Claim 5 is objected to because of the following informalities: X is recited to be "one or more elements other than ... Ta ... " (claim 4), yet claim 5 states that X can comprise Ta. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 2 and 9 – 21 are rejected under 35 U.S.C. 102(a) as being anticipated by Acharya et al. (Proc. of 6th Int. Sym. Mag. Mat., Proc. and Dev., Phoenix, Oct. 2000), as evidenced by Tam et al. (U.S. Patent No. 5,412,809).

Regarding claims 1 and 2, Acharya et al. disclose a magnetic recording medium comprising a substrate (*Figure 4a*), a lower magnetic layer structure formed over said substrate, an intermediate layer comprising Ru, and an upper magnetic layer structure formed over said intermediate layer, said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure (*Pages 5 – 6*).

Regarding the limitation "said lower magnetic layer structure exhibiting a Ms greater than 300 emu/cm^3", the Examiner notes that Acharya et al. disclose that the J values for these materials are ~0.05 – 0.1 erg/cm^2 where $J = H_{ex}M_{s\text{-}L1}\delta_{L1}$ (*page 8*). Figures 7 and 8 disclose an embodiment at δ_{L1} = 3 nm, wherein H_{ex} ~320 Oe. Even assuming the minimum disclosed J value of 0.05, $M_{s\text{-}L1}$ is still calculated to be at least 520 emu/cc (the Examiner notes that 1 erg/Oe = 1 emu).

Regarding claims 9 and 10, Acharya et al. disclose additional layers meeting applicants' claimed structural limitations (*Figure 4a*).

Regarding claim 11, Acharya et al. disclose that synthetic ferrimagnetic media comprising antiferromagnetically coupled magnetic layers through Ru spacer layers can comprise two or more lower magnetic "stabilization layers" (*pages 5 – 6*), thereby meeting applicants' claimed structural limitation of an additional "lowest magnetic layer" and a "second intermediate layer comprising Ru".

Regarding claim 12, Acharya et al. disclose using the media as part of magnetic disk drive (*pages 1 and 2*).

Regarding claims 13 – 21, the Examiner notes that the time to achieve steady state (or "near steady state") is not purely a function of the medium, per se, but is a

function of the magnetic head spacing, the recording density and the seek and/or access time of the magnetic head apparatus (*see Tam et al. col. 2, liens 5 – 39; col. 3, lines 41 – 52; and col. 10, line 29 bridging col. 11, line 6*). Since the claimed time to reach near steady-state magnetization is not a property of the medium, per se, the Examiner has given it little or no weight in determining the patentability of the product because it is not further limiting in so far as the structure of the product is concerned. The limitation "wherein said magnetic disk is incorporated into a disk drive, said magnetic disk rotating" in claim 16 is (an) intended use limitation(s) and is not further limiting in so far as the structure of the product is concerned. Note that "in apparatus, article, and composition claims, intended use must result in a ***structural difference*** between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. ***If the prior art structure is capable of performing the intended use, then it meets the claim***. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art." [emphasis added] *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963). See MPEP § 2111.02. In the instant case, Acharya et al. disclose magnetic disks which the Examiner deems can clearly be rotated in a disk drive.

5. Claims 1, 2, 10 – 21 and 27 – 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Trindade et al. (U.S. Patent App. No. 2003/0035973 A1) as evidenced by Nakamoto et al. (U.S. Patent No. 6,456,466 B1) and Tam et al. ('809).

Regarding claims 1 and 2, Trindade et al. disclose a magnetic recording medium comprising a substrate (*Figure 2, layer 38*), a lower magnetic layer structure formed over said substrate (*Figure 3, layer 44*), an intermediate layer comprising Ru (*Figure 3, layer 46 and Paragraph 0036*), and an upper magnetic layer structure formed over said intermediate layer (*Figure 3, layer 42*), said upper magnetic layer structure being antiferromagnetically coupled to the lower magnetic layer structure (*Paragraph 0012*).

Regarding the limitation "said lower magnetic layer structure exhibiting a Ms greater than 300 emu/cm^3", the Examiner notes that Trindade et al. disclose embodiments comprising permalloy, $Ni_{80}Fe_{20}$ (*Paragraph 0038*) where Nakamoto et al. is cited as evidentiary art that $Ni_{80}Fe_{20}$ possesses a M_s value of ~1.0 T ~796 emu/cm^3 (*col. 6, lines 17 – 21*).

Regarding claims 10 and 11, Trindade et al. disclose additional layers meeting applicants' claimed structural limitations (*Figures 3 and 5 and Paragraphs 0039 and 0040*).

Regarding claim 12, Trindade et al. disclose using the media as part of magnetic disk drive (*Paragraph 0027*).

Regarding claims 13 – 21, the Examiner notes that the time to achieve steady state (or "near steady state") is not purely a function of the medium, per se, but is a function of the magnetic head spacing, the recording density and the seek and/or access time of the magnetic head apparatus (*see Tam et al. col. 2, liens 5 – 39; col. 3, lines 41 – 52; and col. 10, line 29 bridging col. 11, line 6*). Since the claimed time to reach near steady-state magnetization is not a property of the medium, per se, the

Examiner has given it little or no weight in determining the patentability of the product because it is not further limiting in so far as the structure of the product is concerned. The limitation "wherein said magnetic disk is incorporated into a disk drive, said magnetic disk rotating" in claim 16 is (an) intended use limitation(s) and is not further limiting in so far as the structure of the product is concerned. Note that "in apparatus, article, and composition claims, intended use must result in a ***structural difference*** between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. ***If the prior art structure is capable of performing the intended use, then it meets the claim***. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art." [emphasis added] *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); *In re Otto*, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963). See MPEP § 2111.02. In the instant case, Trindade et al. disclose magnetic disks which the Examiner deems can clearly be rotated in a disk drive (*see Figure 1*).

Regarding claims 27 – 37, the claimed relationship between the dynamic coercivity and the exchange coupling field (claims 27 – 29) and the relationship between the short-time coercivity and the exchange coupling field (claims 33 and 34) are functional limitation(s). As defined in the MPEP, "[a] functional limitation is an attempt to define something by what it does, rather than by what it is (e.g., as evidenced by its specific structure or specific ingredients). There is nothing inherently wrong with defining some part of an invention in functional terms. Functional language does not, in and of itself, render a claim improper. *In re Swinehart*, 439 F.2d 210, 169 USPQ 226 (CCPA

1971)" – MPEP § 2173.05(g).. However, the examiner notes that "where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an ***inherent characteristic of the prior art***, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on" (emphasis added) - MPEP § 2183.

In the instant case, the claimed functional limitation(s) are deemed to be an inherent characteristic of the disclosed prior art examples since the prior art is substantially identical in composition and/or structure to applicants' claimed structure (*see claims 38 and 39*). In addition, the Examiner notes that permalloy is known to possess an extremely low static coercivity, i.e. ~100 A/m = ~1.2 Oe (*Nakamoto et al., col. 6, lines 17 – 21*). While the Examiner acknowledges that the dynamic coercivity is generally larger than the static coercivity, especially when measured at a small switching/measurement time, given the extremely low value of the permalloy coercivity and the fact that Trindade et al. states that the exchange coupling force is large enough to create a single domain state within both multi-layered films (*Paragraph 0031*). Therefore, the Examiner deems that the claimed relationship between the dynamic coercivity or short time coercivity and the exchange field would inherently be met by the disclosed embodiments in Trindade et al. (*Paragraphs 0038 and 0040*) since the coercivity and exchange field values are functional limitations depending on the composition and thickness values and the Examiner has sound basis for believing that

the disclosed embodiments would possess values meeting applicants' claimed limitations.

Regarding claims 38 and 39, Trindade et al. disclose magnetically soft material inherently meeting applicants' claimed limitations (*i.e. permalloy* = $Ni_{80}Fe_{20}$).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Trindade et al. as evidenced by Nakamoto et al. and Tam et al. as applied above, and further in view of Chang et al. (U.S. Patent App. No. 2003/0108776 A1).

Trindade et al. is relied upon as described above.

Trindade et al. fail to disclose an "underlayer" formed between the substrate and the lower magnetic layer structure.

However, Chang et al. teach that it is known in the art to form an adhesion layer between a laminated magnetic structure inorder to improve the adhesion of the magnetic layer structure to the substrate (*Paragraph 0024*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicants' invention to modify the device of include an "underlayer" meeting

applicants' claimed structural limitations as taught by Chang et al. to improve the adhesion between the magnetic layer structure and the substrate.

8. Claims 3 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Acharya et al. as evidenced by Tam et al. as applied above, and further in view of Doerner et al. (U.S. Patent No. 6,537,684 B1) and Shinohara et al. (U.S. Patent App. No. 2002/0045069 A1).

Acharya et al. is relied upon as described above.

Acharya et al. fail to disclose the alloy composition used in the magnetic layers, other than noting that they are CoCrPtB layers.

However, Doerner et al. and Shinohara et al. teach that the composition of a CoCr magnetic alloy can be varied to effect the magnetic properties and noise characteristics of the medium (*Doerner et al., col. 2, lines 54 – 63; col. 3, lines 45 – 48; col. 4, lines 56 – 65; col. 5, lines 5 – 7 and 29 – 31; and col. 5, line 55 bridging col. 6, line 21; and Shinohara et al., Paragraphs 0071 – 0079 and 0152*). Therefore, the Examiner deems that it would have been obvious to one having ordinary skill in the art to determine an amount of Co, Cr, Pt, Ta, B and/or Nb meeting applicants' claimed composition limitations by optimizing the results effective variable through routine experimentation, especially given the teachings in Doerner et al. and Shinohara et al. regarding known magnetic alloy compositions for use in antiferromagnetically coupled longitudinal magnetic media. *In re Boesch*, 205 USPQ 215 (CCPA 1980); *In re Geisler*,

116 F. 3d 1465, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997); *In re Aller*, 220 F.2d, 454, 456, 105 USPQ 233, 235 (CCPA 1955).

9. Claims 22 – 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Acharya et al. as evidenced by Tam et al. as applied above, and further in view of Kikitsu et al. (U.S. Patent App. No. 2001/0051287 A1), Igarashi et al. (U.S. Patent App. No. 2002/0132140 A1) and Acharya et al. (Proc. given at Joint Euro. Mag. Symp., Grenoble, France, 9/2001).

Regarding claims 22 – 26, Acharya et al. is relied upon as described above. Acharya et al. further disclose an upper magnetic layer structure comprising an alloy meeting applicants' claimed Ku limitations and that the Ku is a function of the composition of the magnetic layer (*page 11 and Figure 11*).

Acharya et al. fail to disclose using a lower magnetic layer structure comprising a Ku of less than 0.5×10^6 erg/cm^3 (claims 23).

However, Kikitsu et al. and Igarashi et al. teach that in a dual layered recording medium, it is desired to form the lower magnetic layer with a Ku that is smaller than the upper magnetic layer, preferably less than 70% of the Ku value of the upper magnetic layer, inorder to achieve good resolution and good resistance to thermal fluctuations, as well as the ability to achieve recording with magnetic heads currently in use (*Kikitsu et al., Paragraphs 0219 – 0225 and 0235; and Examples 11 – 17; and Igarashi et al., Paragraph 0041*). In addition, Acharya et al. (Proc. at Joint Euro. Mag. Symp.)

illustrates that using a lower layer with a Ku < 0.5 x 10^6 erg/cm^3 results in a layer with a K_uV/k_bT behavior that is relatively insensitive to thickness.

Therefore, the Examiner deems that it would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable such as the Ku value of the lower magnetic layer structure through routine experimentation, especially given the teaching in Kikitsu et al. and Igarashi et al. regarding the desire to minimize the Ku value of the lower magnetic layer relative to the Ku value of the upper magnetic layer inorder to achieve good resolution, good resistance to thermal fluctuations, as well as the ability to achieve recording with the present magnetic heads. In addition, as taught by Acharya et al. (Proc. at Joint Euro. Mag. Symp.), it would have been obvious to use a lower magnetic layer structure possessing a Ku less than 0.5 x 10^6 erg/cm^3 inorder to produce a lower layer with a K_uV/K_bT behavior that was insensitive to the layer thickness.

10. Claims 27 – 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Acharya et al. as evidenced by Tam et al. as applied above, and further in view of Richter et al. (IEEE Trans. Mag., 34(4), 1998, 1540 – 1542) and Richter et al. (IEEE Trans. Mag., 37(4), 2001, 1441 – 1444).

Acharya et al. is relied upon as described above. Acharya et al. further disclose that the coercivity of the lower layer must be less than the exchange force inorder to enable switching in a positive field, including specific embodiments wherein the coercivity is less than half the exchange force (*Figure 7a and 8 and page 8*). Finally,

Acharya et al. disclose the behavior of the dynamic coercivity with respect to the measurement time in Figure 5, though this is for the entire medium and not for each layer individually (*see also pages 6 – 7*).

Acharya et al. fail to disclose controlling the dynamic coercivity (claims 27 – 32) nor the short-time coercivity (claims 33 – 37) such that they are less than the exchange force (or less than half the exchange force).

However, Richter et al. (both references) teach that it is desired to minimize the short-time coercivity and the dynamic coercivity to insure a small difference between the writing coercivity and the storage (long-time) coercivity inorder avoid writing problems by avoiding the superparamagnetic limit associated with high coercivity values at short times (*Introduction sections of both references and Figures in the 1998 reference*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Acharya et al. to use a lower magnetic layer possessing a relatively flat dynamic coercivity curve as taught by Richter et al. ('2001) since "only *if the dynamic coercivity curve of AFC media* is flatter than that of conventional media, can smaller grains be employed and an SNR gain be realized" (*Introduction*). Specifically, it would have been obvious to one of ordinary skill to minimize the dynamic coercivity and the short-time coercivity values since the long-time coercivity values must be minimized to enable switching in a positive field and by insuring a flat dynamic coercivity curve, the AFC media can avoid the superparamagnetic limit and achieve an improved SNR.

Regarding claim 29, the Examiner notes that the claimed limitation is simply designating which portion of the dynamic coercivity curve is being considered, i.e. the 1 – 10 ns portion of the curve. Since one of ordinary skill in the art would be motivated to produce as flat a curve as possible, given the teachings in Richter et al. and Richter et al. above, the Examiner deems that it would have been obvious to control the dynamic coercivity in this range to meet applicants' relative value limitation for identical reasons as stated above.

11. Claims 38 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Acharya et al. as evidenced by Tam et al. as applied above, and further in view of Igarashi et al. ('140 A1) and Carey et al. (U.S. Patent App. No. 2003/0022023 A1).

Acharya et al. is relied upon as described above.

Acharya et al. fail to disclose a lower magnetic layer structure comprising a magnetically soft material with intergranular decoupling selected from the group listed in claim 39.

However, the Examiner deems that the CoCrPtB magnetic alloys and magnetically soft materials with intergranular decoupling, i.e. permalloy, are known equivalents in magnetic materials for use in the lower magnetic structure of an antiferromagnetically coupled recording medium. Specifically, Igarashi et al. teach an antiferromagnetically coupled recording medium wherein the lower magnetic layer (*layer 12*) can comprise CoCrPt alloys, as well as known soft magnetic materials "FeNiCo, CoFeTa, NiTa, CoW, CoNb, ... Fe-N" (*Paragraph 0036*). Carey et al. teach that

materials meeting applicants' claimed Markush limitations are known equivalent to the alloys listed by Igarashi et al. (*Paragraph 0024: "In addition to CoFe, other magnetically permeable materials suitable for the FM layers are alloys of CoNiFe, FeCoB, CoCuFe, NiFe, FeAlSi, FeTaN, FeN, FeTaC, CoTaZr, CoFeB, and CoZrNb*)

Substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. In the instant case, CoCr alloys and magnetically soft materials with intergranular decoupling meeting applicants' Markush limitation are equivalents in the field of ferromagnetic alloys useable as the lower magnetic layer structure in an antiferromagnetically coupled recording medium, as taught by Igarashi et al. and Carey et al. above. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Girt (U.S. Patent App. No. 2003/0104247 A1) teach antiferromagnetically coupled recording media wherein high Ms layers are deposited adjacent to a Ru antiferromagnetically coupling layer (*Figure 8 and Paragraphs 0015 – 0028*). Inomata et al. (U.S. Patent App. No. 2002/0039668 A1) teach the equivalence of a single magnetic layer structure or a plurality of layers in an antiferromagnetically coupled medium (*Paragraphs 0047, 0050, 0054, 0055, and 0083*). Abarra et al. (IEEE. Trans. Mag. 37(4), 2001, 1426 – 1431) teach a 2 or 3 magnetic layer

antiferromagnetically coupled medium (*Figure 1*) wherein the coercivity of the lower layer(s) is less than half the exchange force (*page 1428, 1st column*). Paper titled "Preparation of Papers for 20th IEEE SOFE" disclose conversion relationships used to calculate the Ms for permalloy.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (703) 308-1737. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on (703) 308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0651.

Kevin M. Bernatz
Patent Examiner

September 3, 2003